<u>WHAT IS CLAIMED IS:</u>

Sub B3

1. A brushless electrical machine comprizing:

a rotor;

a stator;

at least one phase winding arranged to establish flux in a magnetic circuit in the machine; and

means for producing a signal indicative of flux-causing voltage across the at least one phase winding.

2. A machine as claimed in claim 1 in which the means for producing the signal indicative of the flux-causing voltage is operably coupled with the or each phase winding.

3. A machine as claimed in claim 2 in which the means for producing includes a search coil arranged in relation to the magnetic circuit to produce the signal indicative of the flux-causing voltage.

4. A brushless electrical drive system comprising:

a brushless electrical machine having a rotor, a stator and at least one phase winding arranged to establish flux in a magnetic circuit in the machine;

means for determining flux-causing voltage across the or each phase winding and producing a feedback signal representing the flux-causing voltage; and

a flux controller having an input signal representing the demanded output of the machine, which controller is responsive to the input signal and the feedback signal to produce control signals for actuating switch means to control the flux in the at least one phase winding.

Sub C1

5. A system as claimed in ~~any of~~ claim 4 in which the means for determining the flux-causing voltage include transducer means operably coupled with the or each phase winding.

6. A system as claimed in claim 5 in which the transducer means includes a search coil.

7. A system as claimed in claim 4 in which the means for determining the flux-causing voltage is part of a flux estimator including means for deriving a flux signal proportional to the flux in the or each phase winding from the feedback signal.

8. A system as claimed in claim 7 in which the means for determining the flux-causing voltage includes a voltage model of the machine for producing the feedback signal.

9. A system as claimed in claim 8 in which the voltage model includes a thermal model of the or each phase winding.

10. A system as claimed in claim 7 in which the means for deriving the flux signal includes an integrator arranged to integrate the feedback signal to produce the flux signal.

11. A system as claimed in claim 9, in which the estimator includes means for resetting the integrator at a point of substantially zero phase current in the cycle of the or each phase of the machine.

12. A system as claimed in claim 7 in which the means for deriving the flux signal includes a low-pass filter arranged to filter the feedback signal to produce the flux signal.

13. A system as claimed in claim 7 in which the estimator includes a current model of the machine arranged to receive signals representing phase current and rotor position and being operable to produce a flux estimate for the or each phase winding therefrom.

14. A system as claimed in claim 13 in which the current model includes an algebraic estimate of the flux in the or each phase winding based on inputs of phase current and rotor position.

15. A system as claimed in claim 13 in which the estimator includes comparator means for producing a current model error signal from the flux estimate and the feedback signal.

16. A system as claimed in claim 13 in which the current model is an inverse current model, including an algebraic estimate of the current in the or each phase winding based on inputs of rotor position and estimated phase flux.

17. A system as claimed in claim 16 in which the estimator includes comparator means for producing an inverse current model error signal from the current estimate and monitored current in the or each phase winding.

18. A system as claimed in claim 13 in which the means for determining the flux-causing voltage includes a voltage model of the machine for producing the feedback signal, further in which the estimator further includes means for summing output of the voltage model and differentiated output of the current model to produce the feedback signal.

19. A system as claimed in claim 13 in which the estimator further includes a current model controller arranged to apply a control law function to current model output.

20. A system as claimed in claim 19 in which the current model controller has a response to machine speed such that a current model output signal is increasingly attenuated with increasing machine speed above a predetermined machine speed.

21. A system as claimed in claim 13 in which the means for determining the flux-causing voltage includes a voltage model of the machine for producing the feedback signal, the system further including means for causing output of the current model to dominate output of the voltage model at relatively low machine speeds, and for causing output of the voltage model to dominate output of the current model at relatively high machine speeds.

22. A system as claimed in claim 4 in which the input signal represents a flux demand, the flux controller further including a comparator for comparing determined flux with demanded flux to produce the control signals.

23. A method for controlling a brushless electrical machine having a rotor, a stator and at least one phase winding, the method comprising:

producing a feedback signal including a part indicative of the flux-causing voltage across the or each phase winding;

producing an input signal representing the demanded output of the machine; and

controlling energization of the at least one phase winding in response to the input signal and the feedback signal.

24. A brushless electrical machine comprising:

a rotor;

a stator;

at least one phase winding arranged to establish flux in a magnetic circuit in the machine; and

a signal producer arranged in relation to the magnetic circuit for producing a signal indicative of flux-causing voltage across the at least one phase winding.